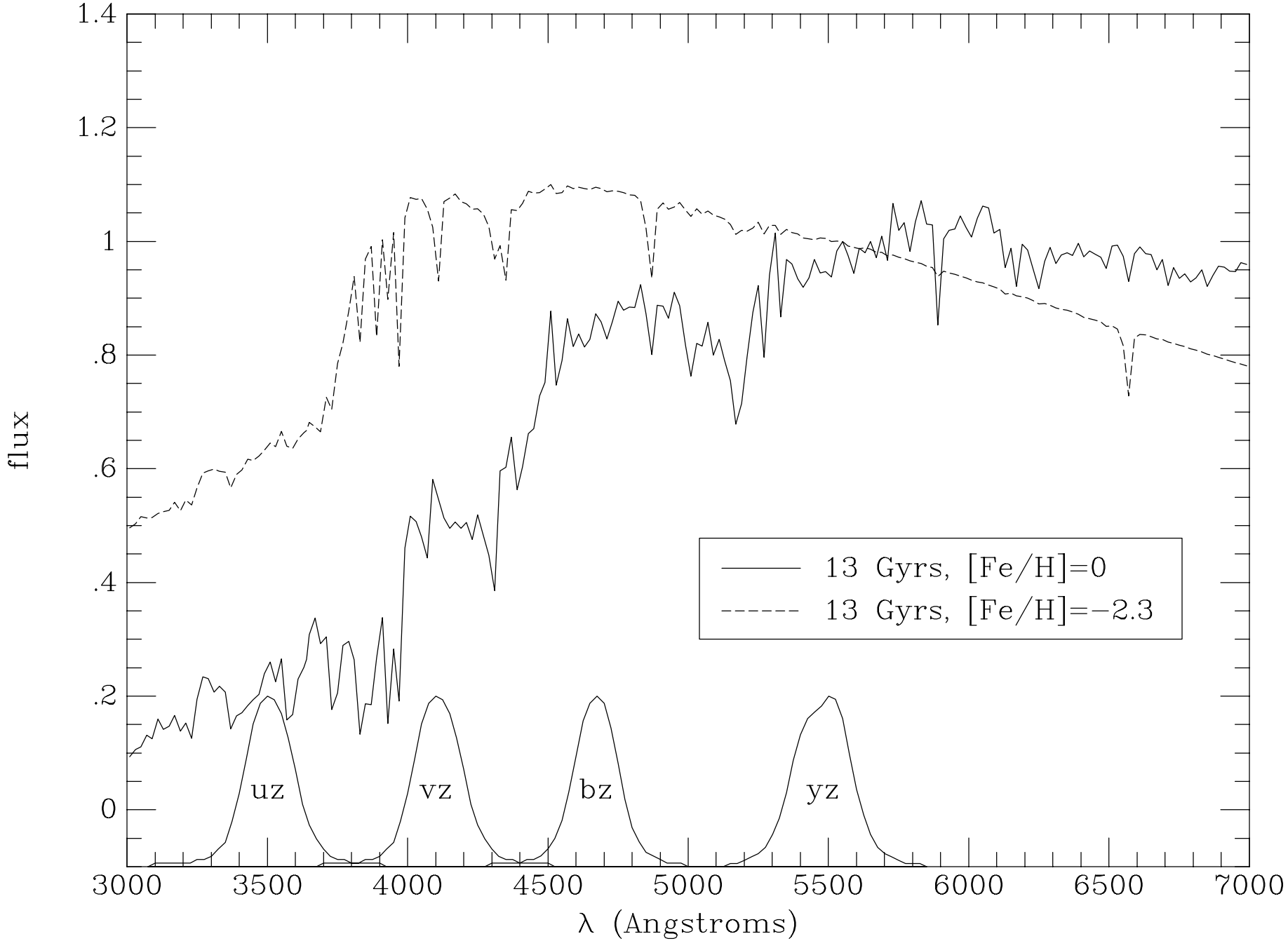
[10pt,aaspp4,flushrt]article document

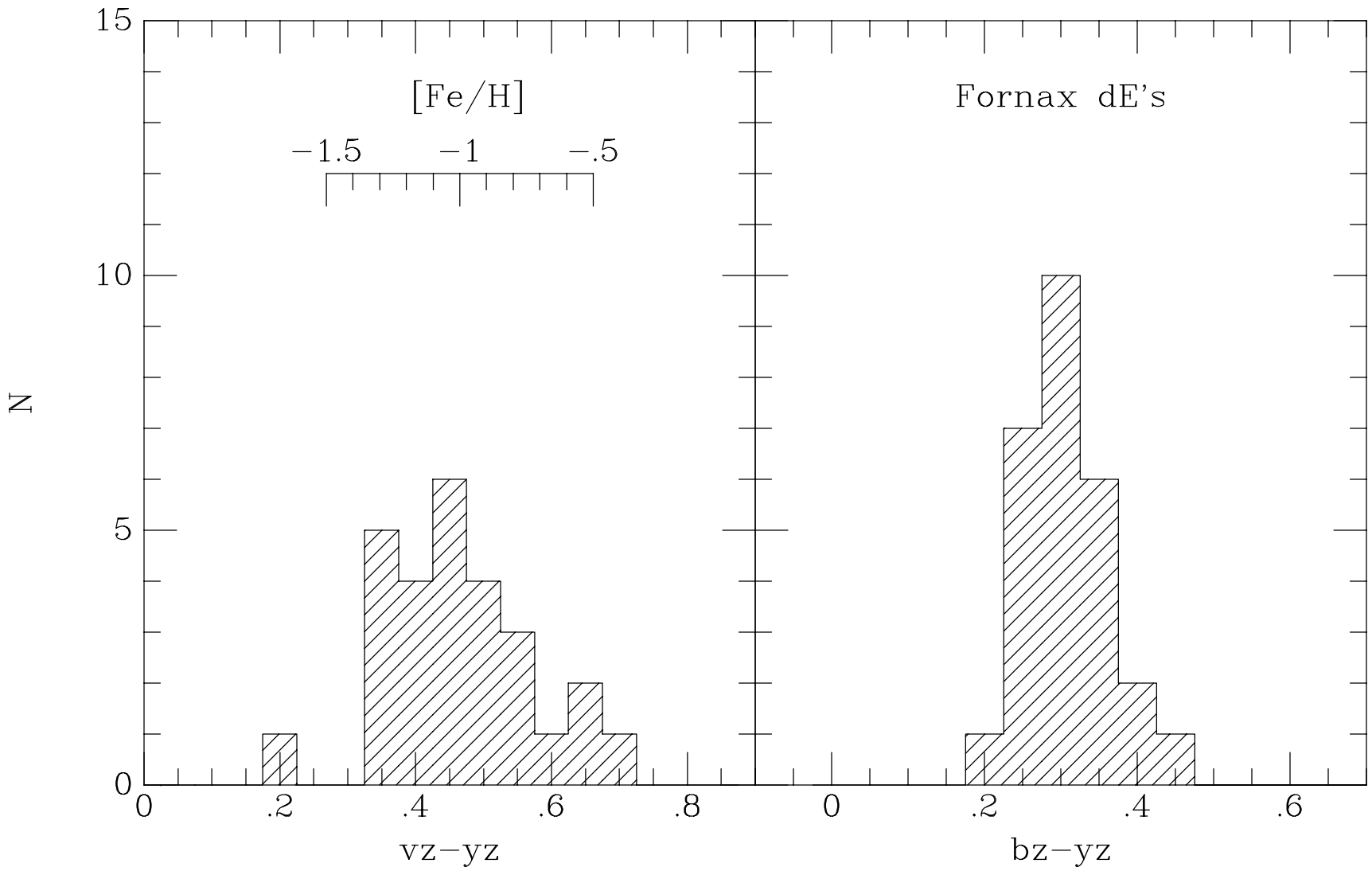
Ages and Metallicities of Fornax Dwarf Ellipticals

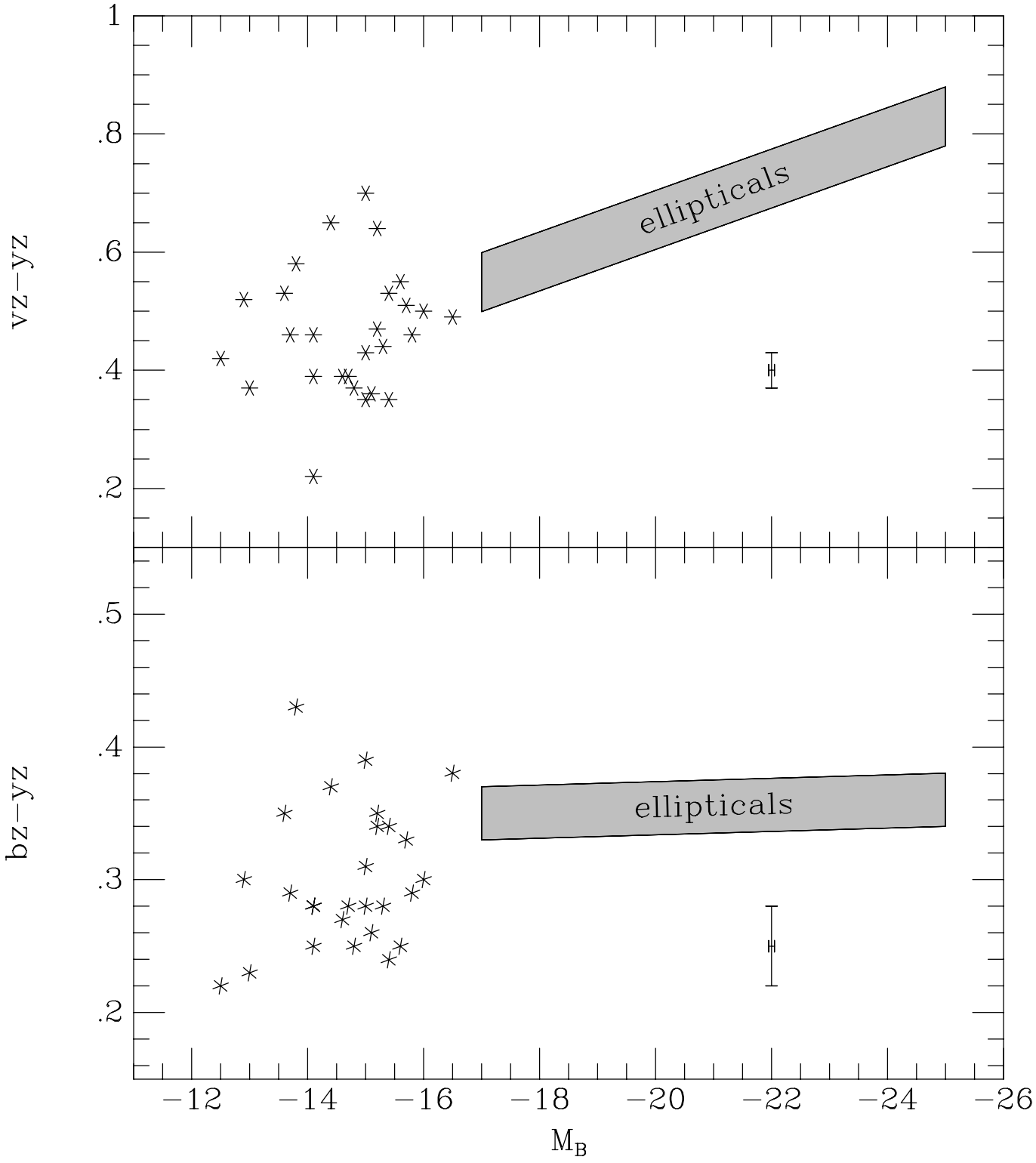
Karl Rakos Institute for Astronomy, University of Vienna, A-1180, Wien, Austria; karl.rakos@chello.at
James Schombert Department of Physics, University of Oregon, Eugene, OR 97403; js@abyss.uoregon.edu
H.M. Maitzen Institute for Astronomy, University of Vienna, A-1180, Wien, Austria
Sinisa Prugovecki University of Zagreb, Croatia
Andrew Odell Department of Physics and Astronomy, Northern Arizona University, Box 6010, Flagstaff, AZ 86011; andy.odell@nau.edu

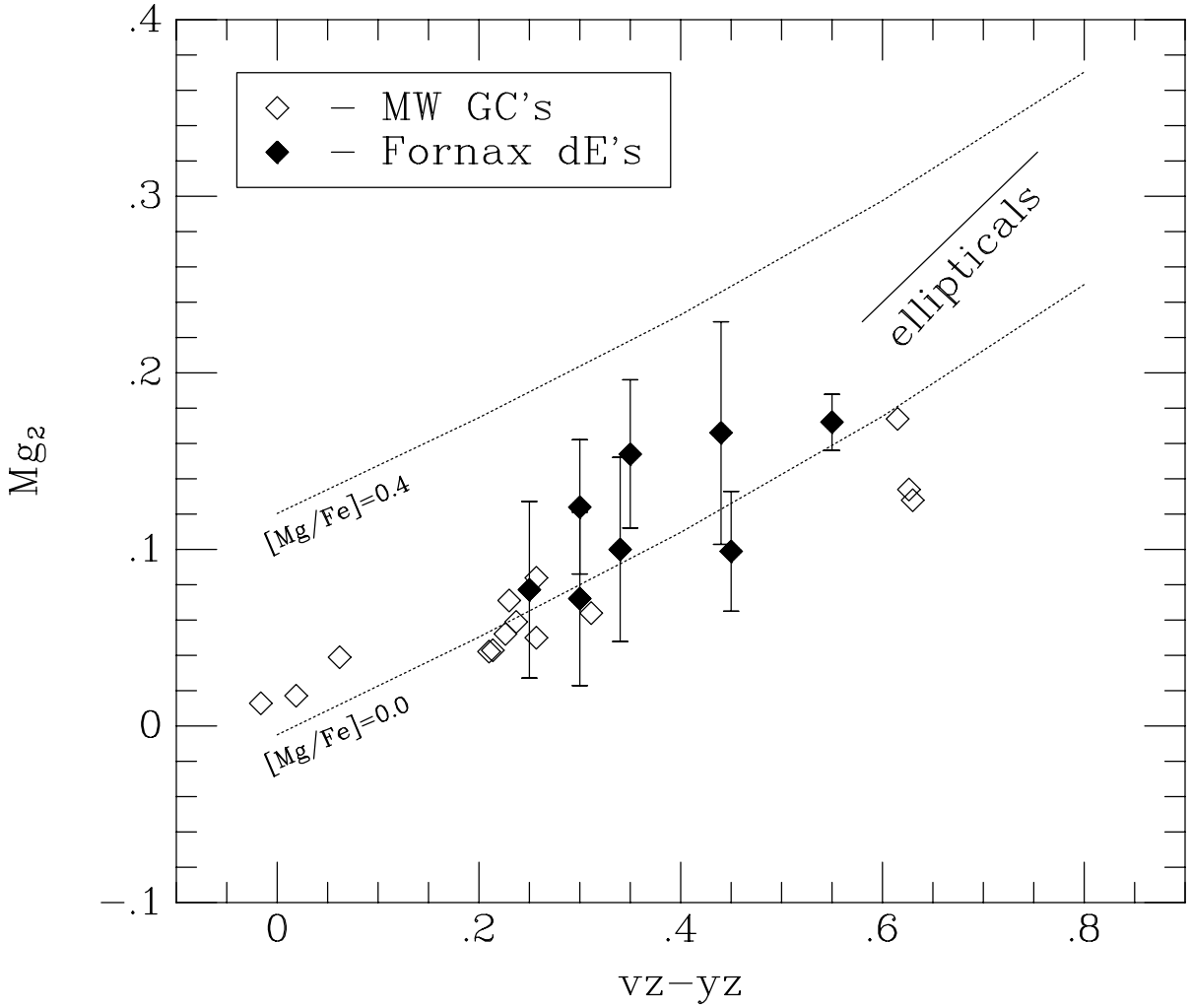
abstract

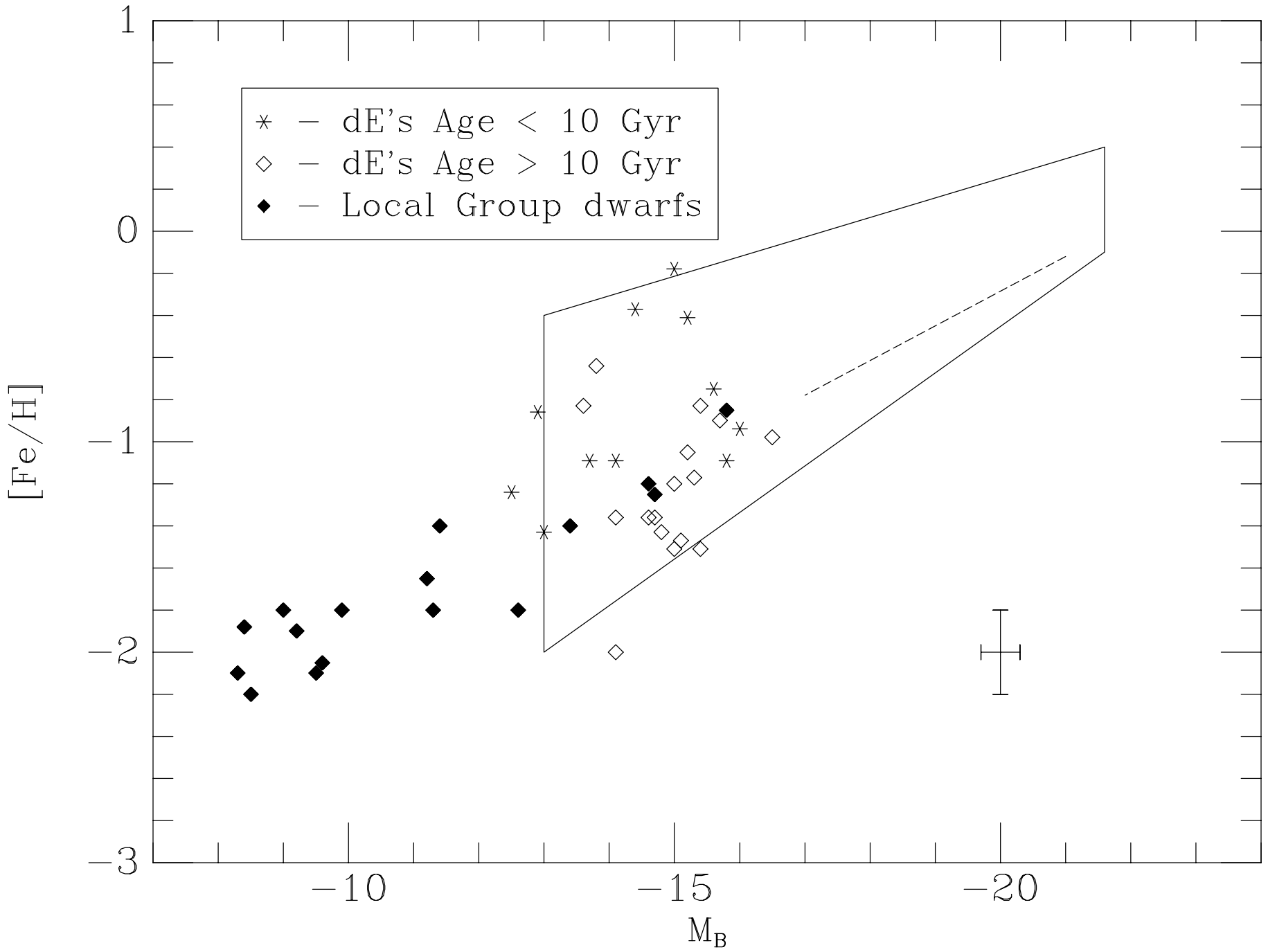
Narrow band photometry is presented on 27 dwarf ellipticals in the Fornax cluster. Calibrated with Galactic globular cluster data and spectrophotometric population models, the colors indicated that dwarf ellipticals have a mean [Fe/H] of -1.00 ± 0.28 ranging from -1.6 to -0.4. The mean age of dwarf ellipticals, also determined photometrically, is estimated at 10 ± 1 Gyrs compared to 13 Gyrs for bright Fornax ellipticals. Comparison of our metallicity color and Mg_2 indices demonstrates that the [Mg/Fe] ratio is lower in dwarf ellipticals than their more massive cousins, which is consistent with a longer duration of initial star formation to explain their younger ages. There is a increase in dwarf metallicity with distance from the Fornax cluster center where core galaxies are, on average, 0.5 dex more metal-poor than halo dwarfs. In addition, we find the halo dwarfs are younger in mean age compared to core dwarfs. One possible explanation is that the intracluster medium ram pressure strips the gas from dwarf ellipticals halting star formation (old age) and stopping enrichment (low metallicity) as they enter the core.

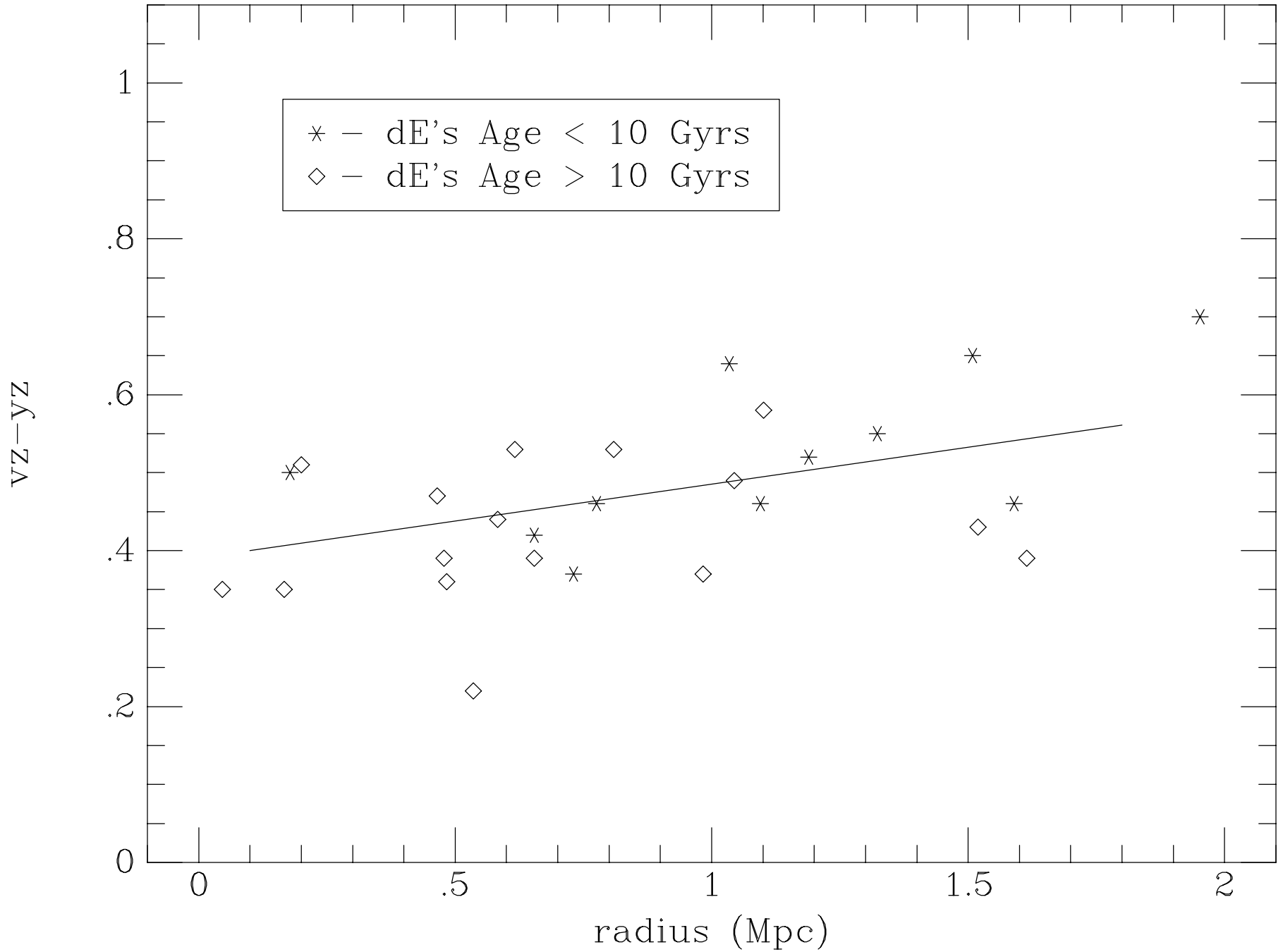

1.4
1.2
1
.8
.6
.4
.2
0
flux
3000
3500
4000
4500
5000
5500
6000
6500
7000
λ (Angstroms)
13 Gyrs, [Fe/H]=0
13 Gyrs, [Fe/H]=−2.3
uz
vz
bz
yz

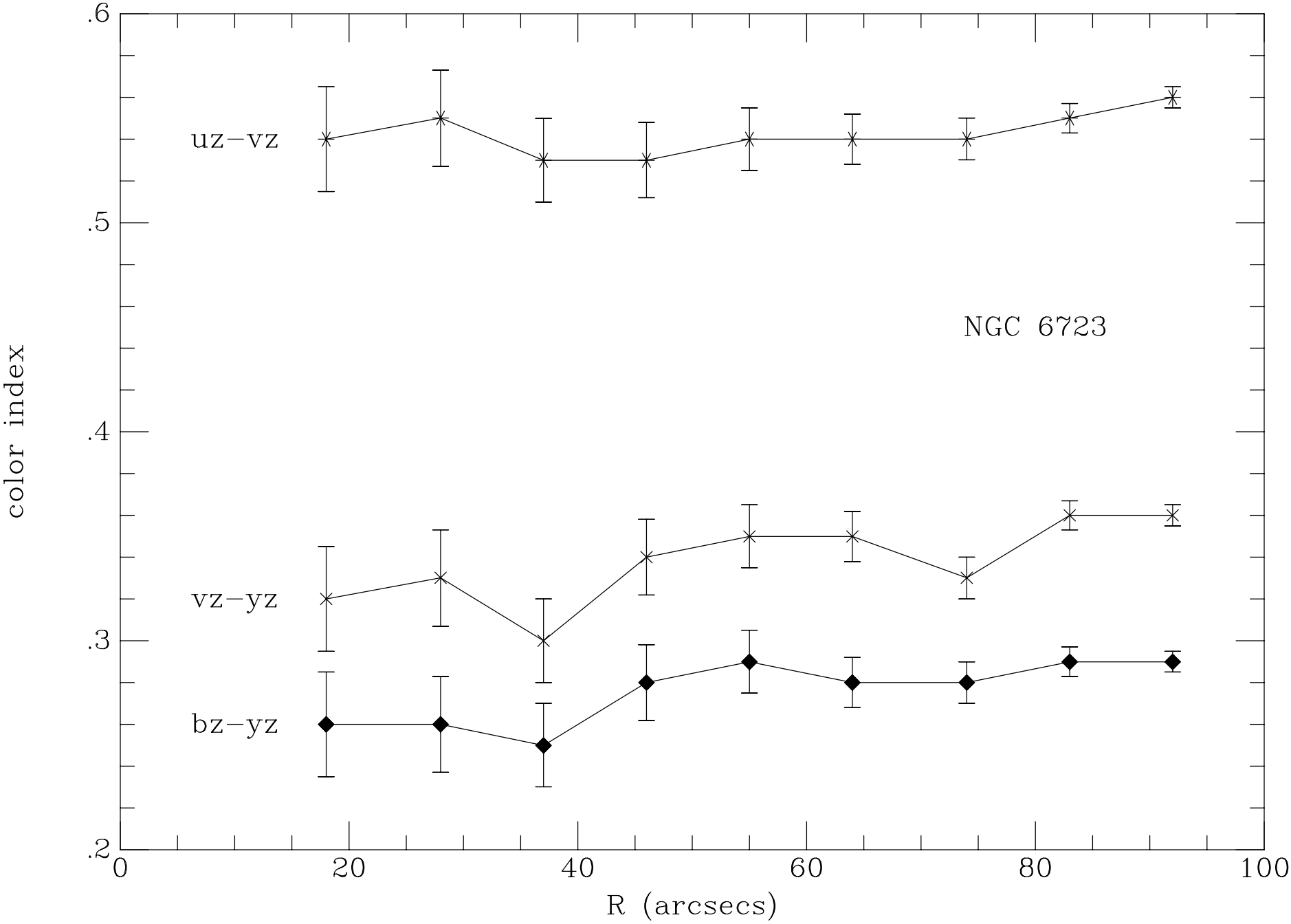

15
10
5
0
N
[Fe/H]
−1.5
−1
−.5
Fornax dE's
0
.2
.4
.6
.8
vz−yz
0
.2
.4
.6
bz−yz

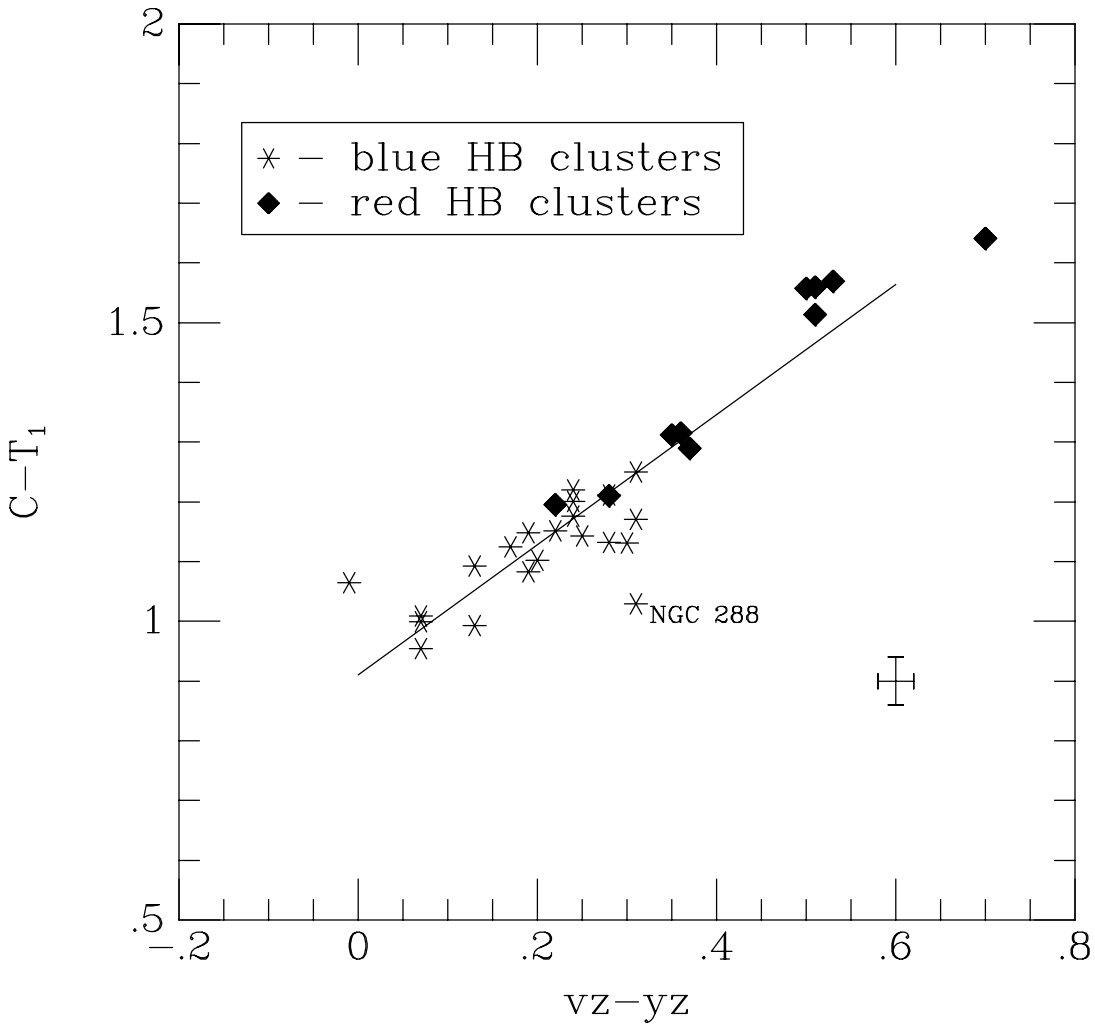

1
.8
.6
.4
.2
vz−yz
ellipticals
.5
.4
.3
.2
bz−yz
ellipticals
−12
−14
−16
−18
−20
−22
−24
−26
M_B

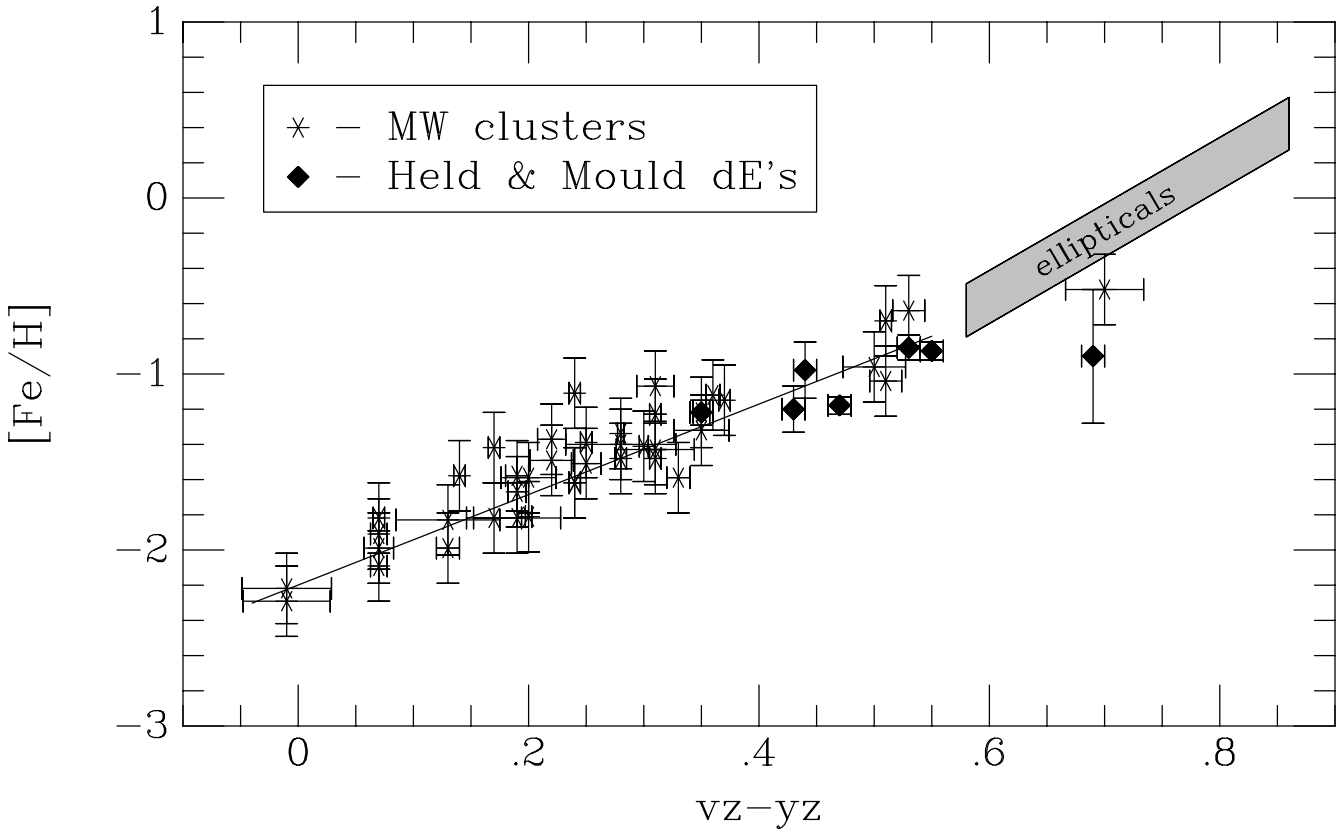

MW GC's
Fornax dE's
ellipticals
[Mg/Fe]=0.4
[Mg/Fe]=0.0
Mg2
vz−yz
.4
.3
.2
.1
0
−.1
0
.2
.4
.6
.8

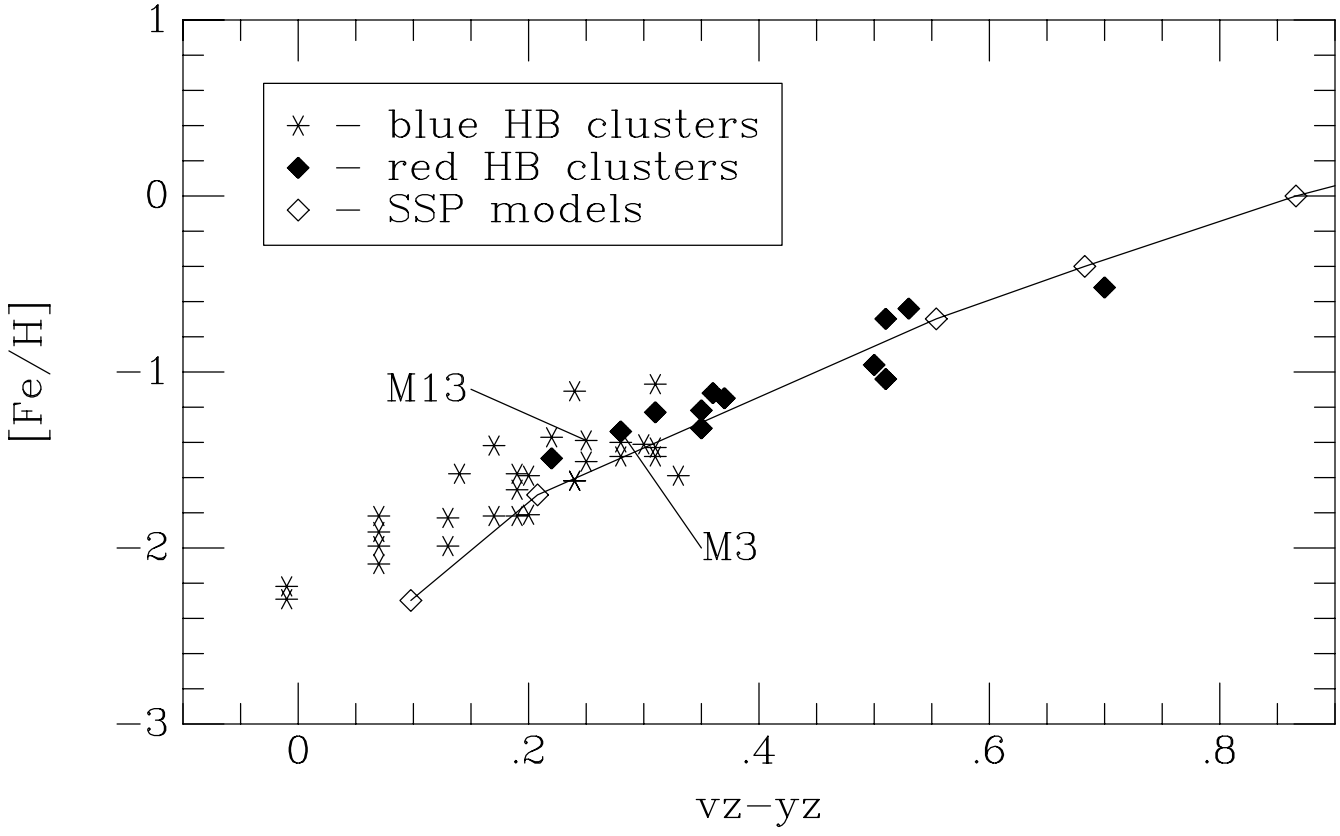

* – dE's Age < 10 Gyr
◇ – dE's Age > 10 Gyr
◆ – Local Group dwarfs
[Fe/H]
M_B
1
0
−1
−2
−3
−10
−15
−20

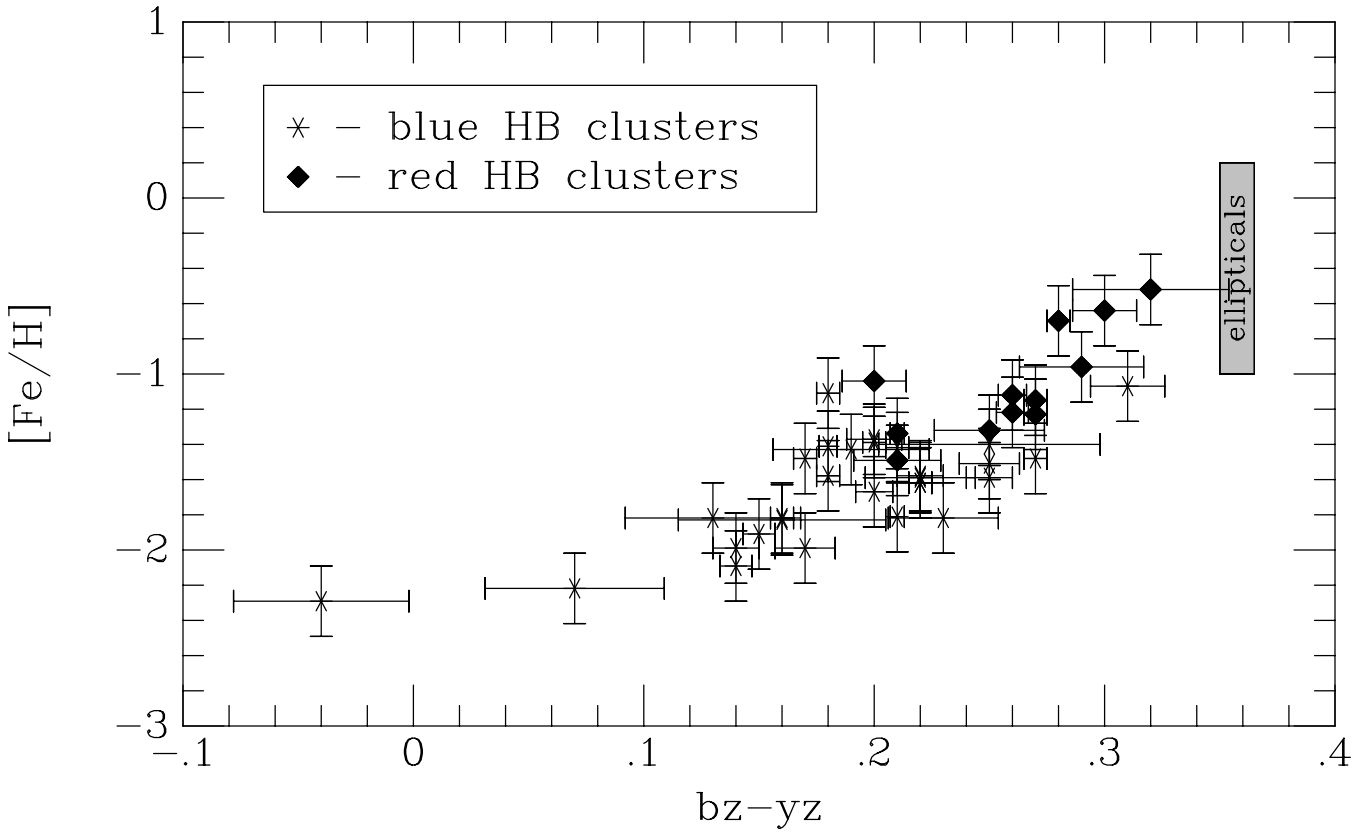

* – dE's Age < 10 Gyrs
◇ – dE's Age > 10 Gyrs
vz−yz
radius (Mpc)
0
.2
.4
.6
.8
1
0
.5
1
1.5
2

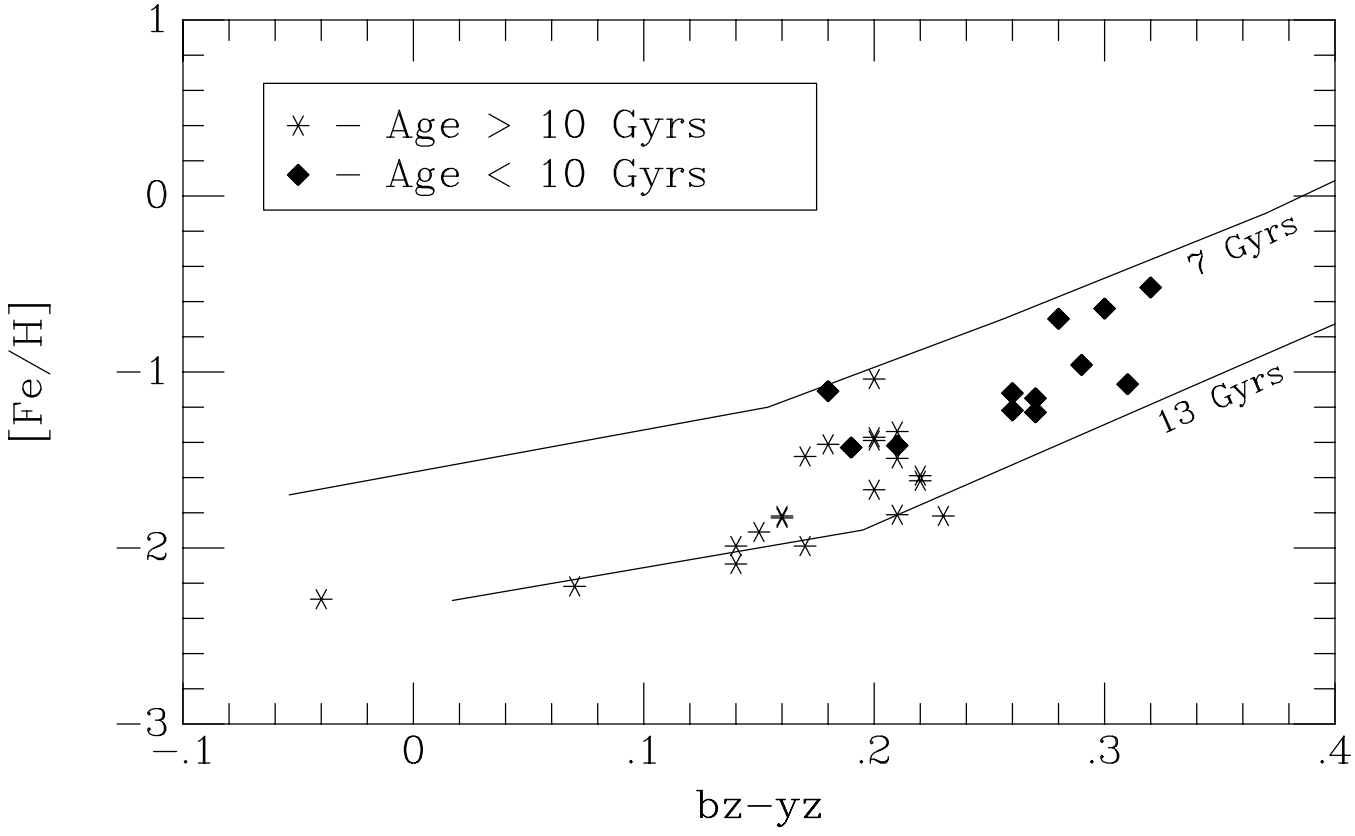

.6
.5
.4
.3
.2
color index
uz−vz
vz−yz
bz−yz
NGC 6723
0
20
40
60
80
100
R (arcsecs)

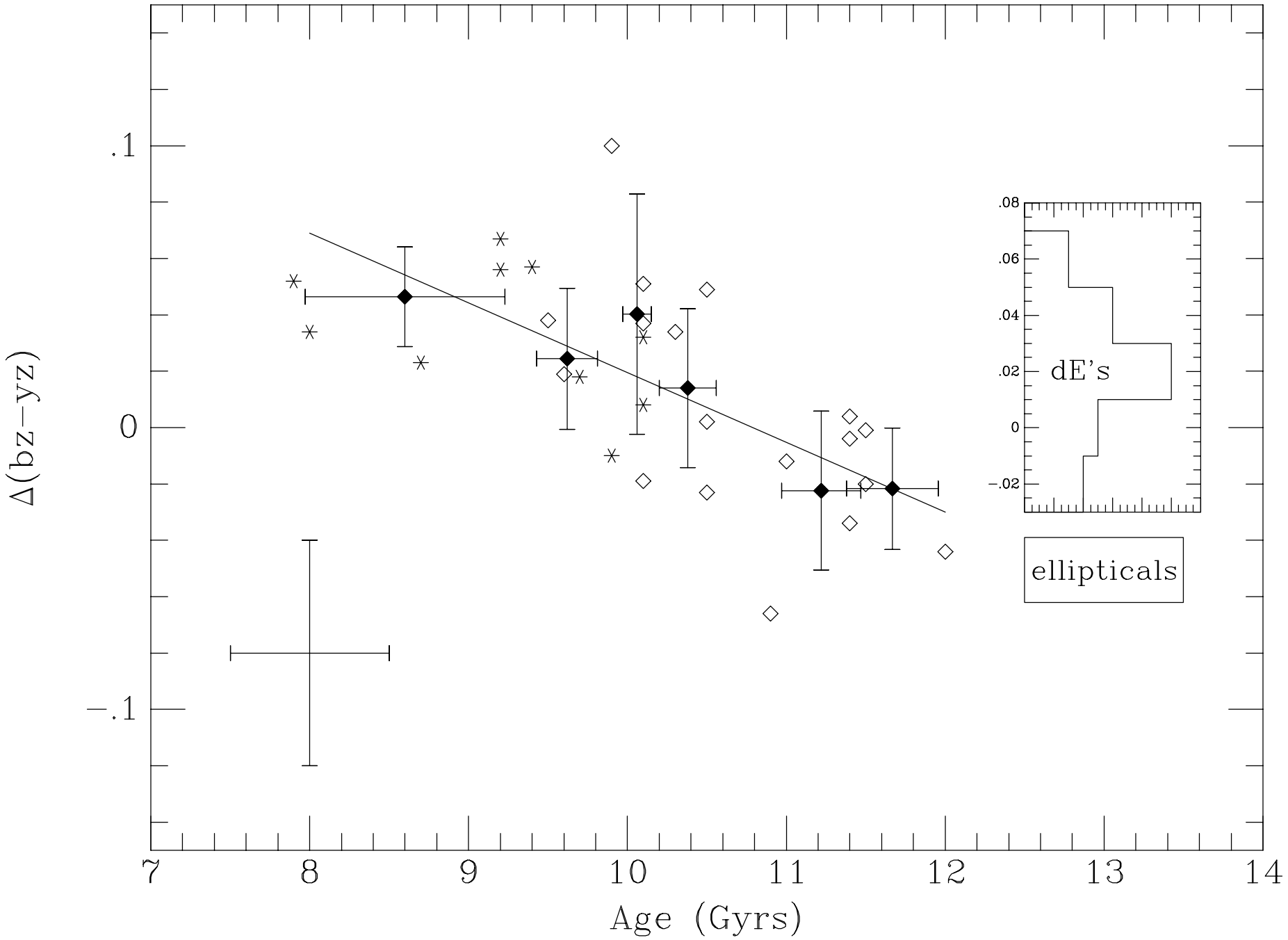

2
1.5
1
.5
−.2
0
.2
.4
.6
.8
C−T1
vz−yz
blue HB clusters
red HB clusters
NGC 288

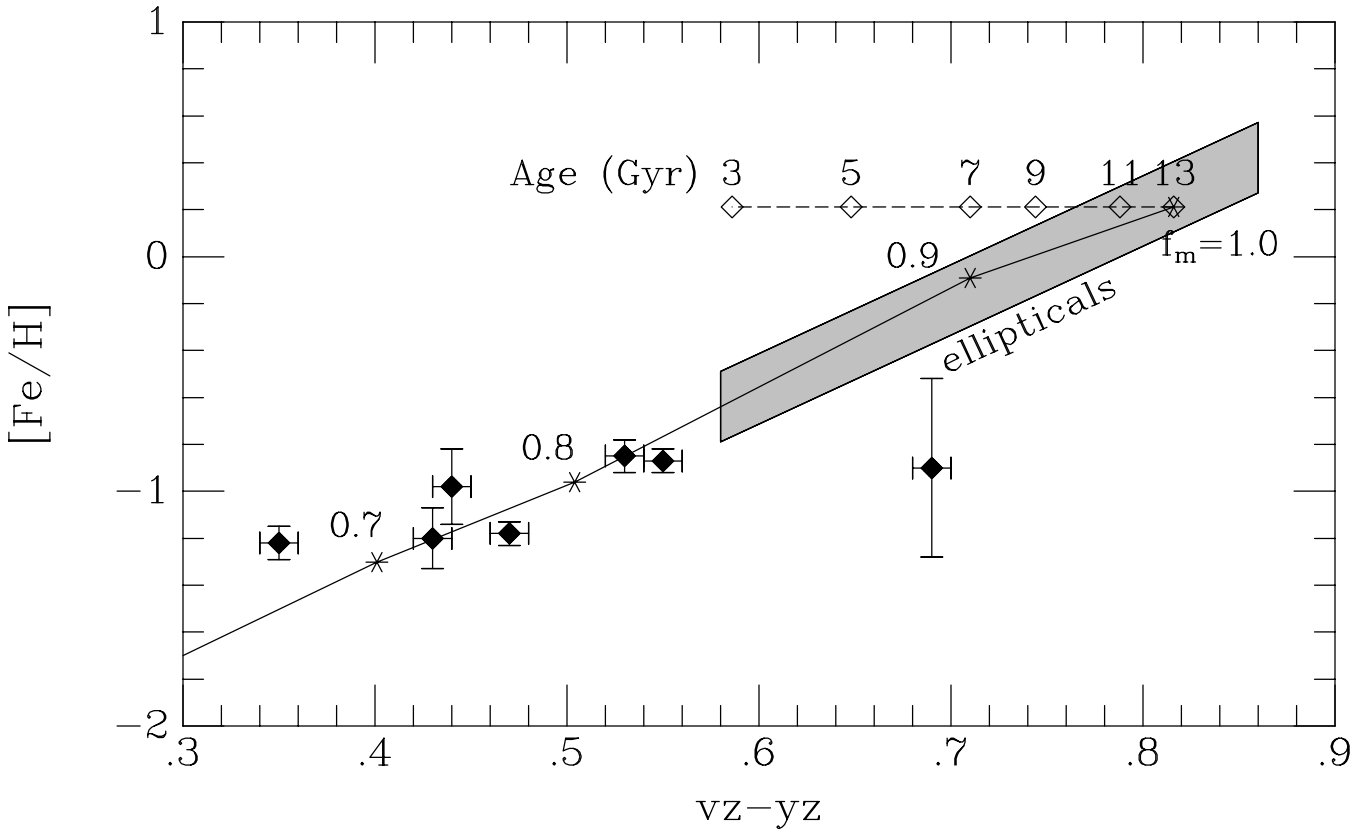

1
0
−1
−2
−3
[Fe/H]
0
.2
.4
.6
.8
vz−yz
✳ − MW clusters
◆ − Held & Mould dE's
ellipticals

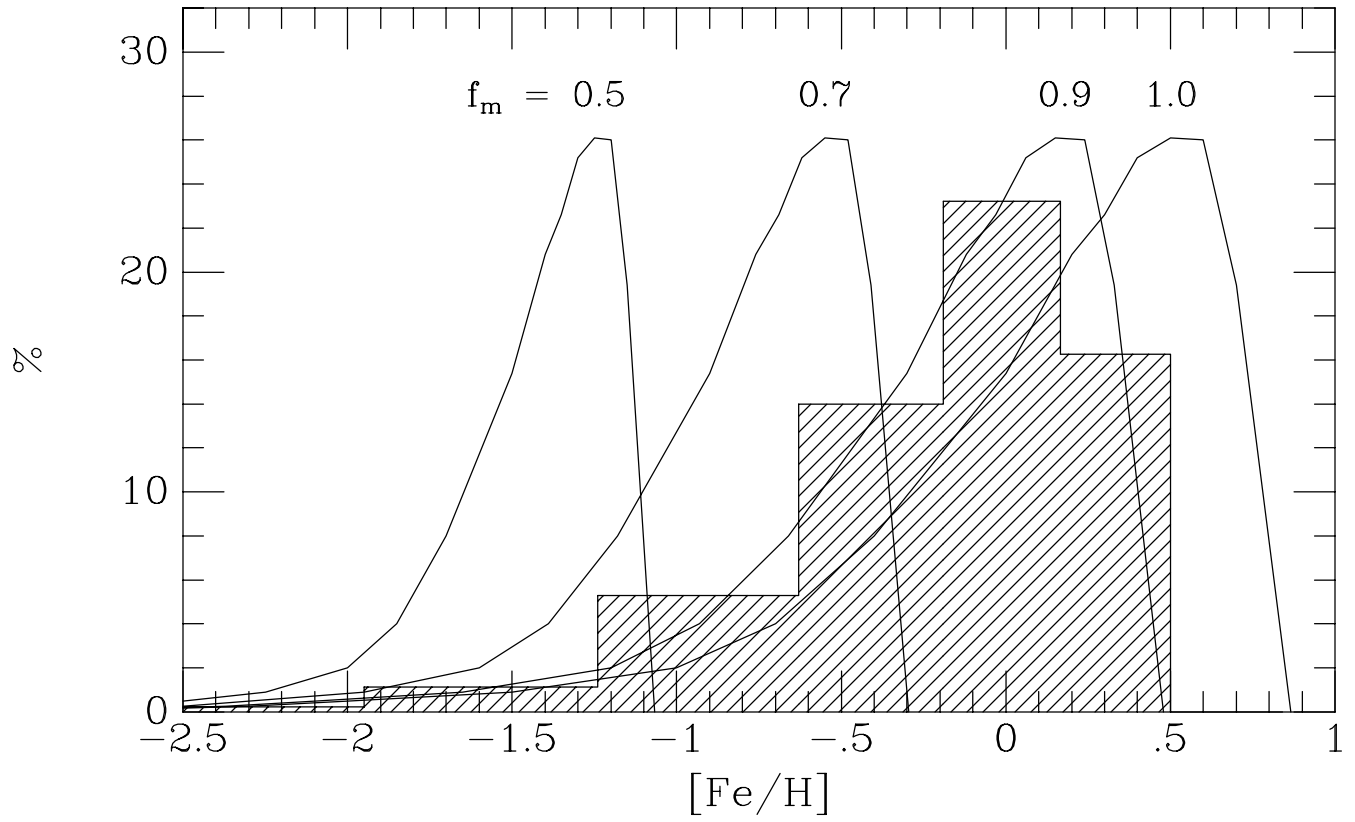

1
0
−1
−2
−3
[Fe/H]
0
.2
.4
.6
.8
vz−yz
✳ − blue HB clusters
◆ − red HB clusters
◇ − SSP models
M13
M3

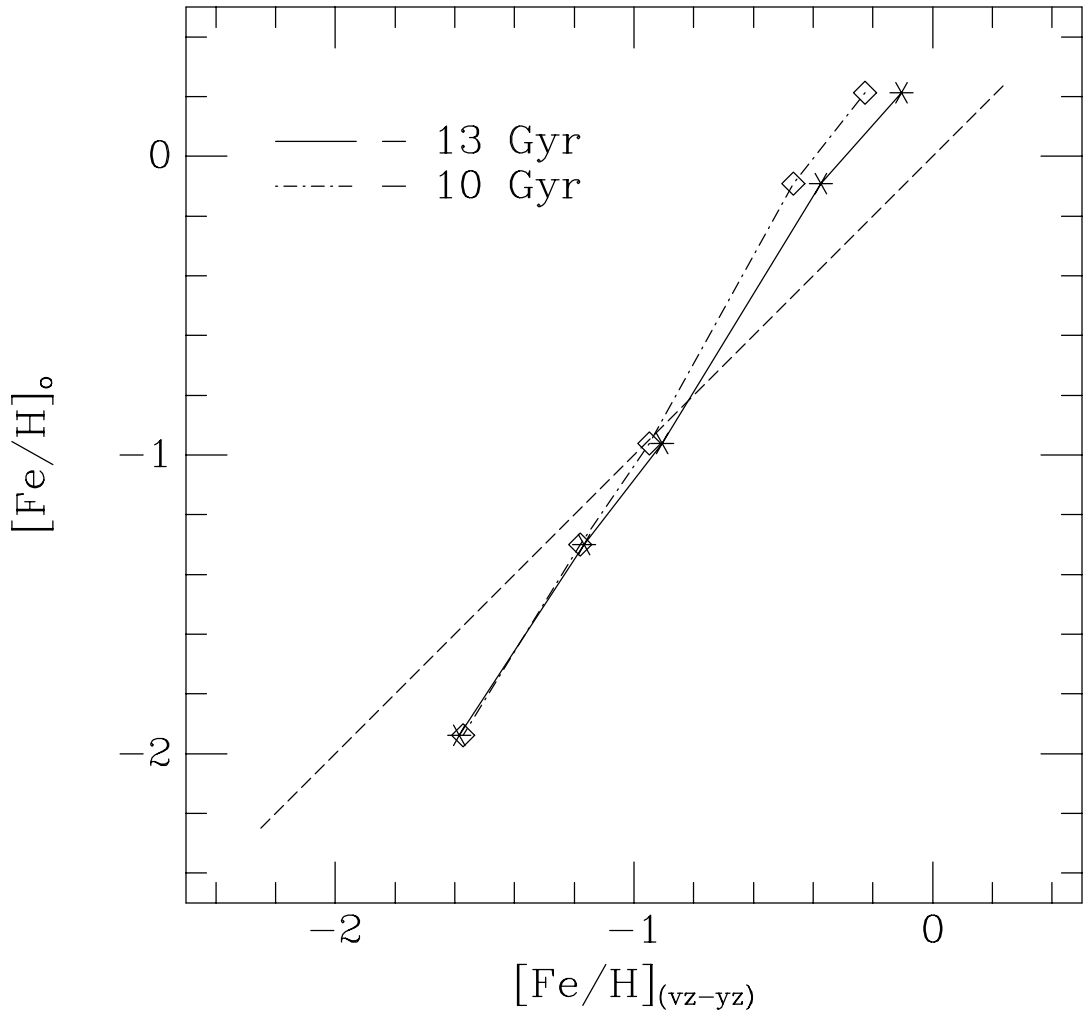

1
0
−1
−2
−3
−.1
0
.1
.2
.3
.4
[Fe/H]
bz−yz
✳ − blue HB clusters
◆ − red HB clusters
ellipticals


1
0
−1
−2
−3
−.1
0
.1
.2
.3
.4
[Fe/H]
bz−yz
✳ − Age > 10 Gyrs
◆ − Age < 10 Gyrs
7 Gyrs
13 Gyrs


.1
0
−.1
Δ(bz−yz)
7
8
9
10
11
12
13
14
Age (Gyrs)
.08
.06
.04
.02
0
−.02
dE's
ellipticals


Age (Gyr) 3 5 7 9 11 13
f_m=1.0
0.9
0.8
0.7
ellipticals
[Fe/H]
vz−yz
1
0
−1
−2
.3
.4
.5
.6
.7
.8
.9


f_m = 0.5
0.7
0.9
1.0
%
[Fe/H]
30
20
10
0
−2.5
−2
−1.5
−1
−.5
0
.5
1


13 Gyr
10 Gyr
0
−1
−2
−2
−1
0
[Fe/H]∘
[Fe/H](vz−yz)